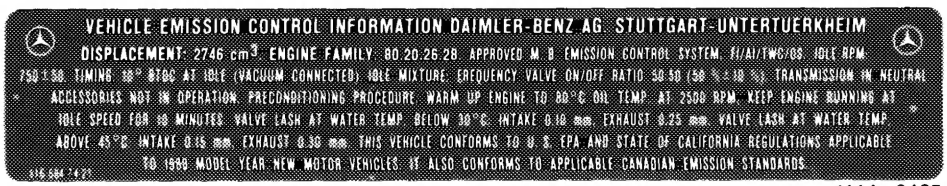
Model year 1980/81

A. General information

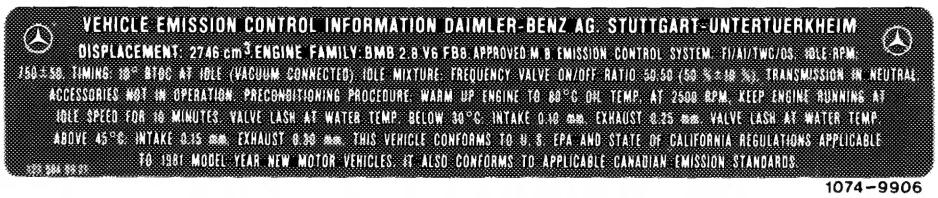
Contrary to model years 1977–1979 a uniform emission control system is installed for Federal system and California.

Information plate model year 1980



1144 – 9407

Information plate model year 1981



1074–9906

For model year 1980, the engine identification data are encoded in an 8-digit code number.

Example: Engine Family 80.20.26.28 (model year 1980)

80 20 2 6 28

Model year 80

National code number 20

20 = Federal and California
21 = Federal
22 = California

Combustion system 2

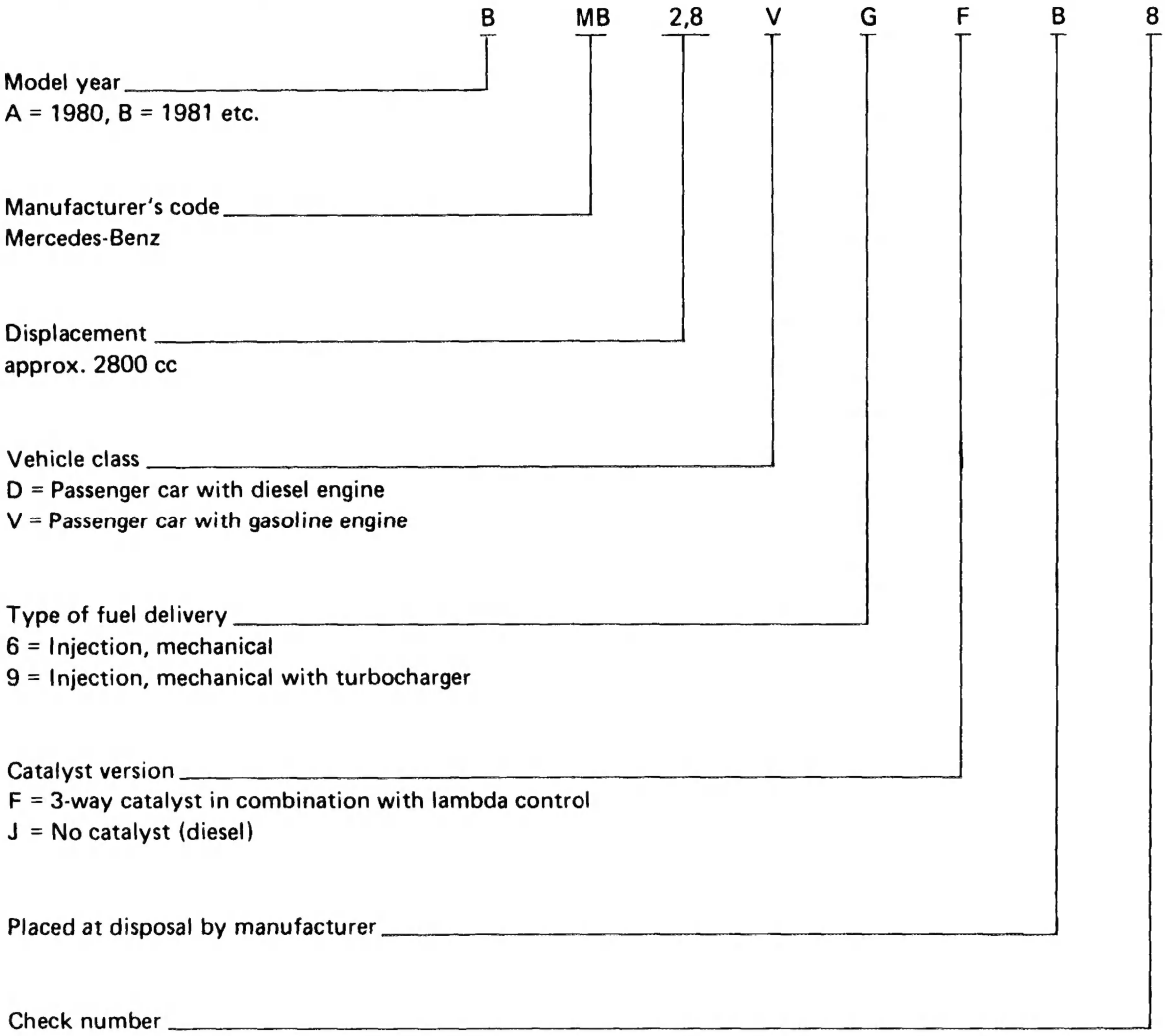
1 = Carburetor
2 = Injection, gasoline
3 = Diesel
4 = Diesel, turbo

Number of cylinders 6

Displacement
approx. 2800 cc 28

For model year 1981 the engine identification data are encoded in a 10-digit code.

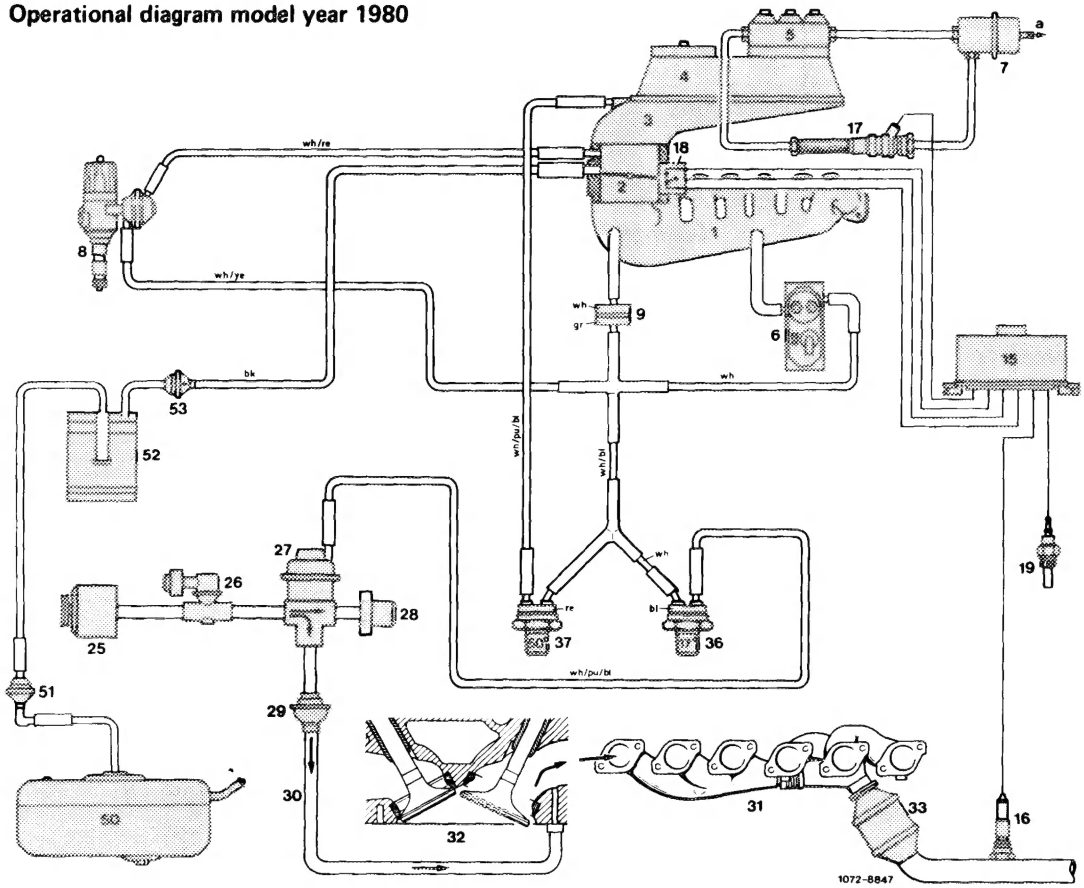
Example: Engine Family B MB 2,8 V6FB8 (model year 1981)



Identification of vacuum lines model year 1980

The basic color of vacuum lines for emission control system is transparent (white).	Additional color stripes are used for easier identification of individual functions.
Emission control device	
Ignition	
Ignition advance	red
Ignition retard	yellow/purple
Air injection	blue

Operational diagram model year 1980



1 Intake manifold
2 Throttle valve housing
3 Air guide housing
4 Air flow sensor
5 Fuel distributor
6 Warm-up compensator
7 Damper
8 Ignition distributor
9 Orifice
15 Control unit
16 Oxygen sensor
17 Frequency valve
18 Throttle valve switch
19 Temperature switch oil 16 °C/60 °F
25 Air pump
26 Pressure relief valve
27 Air relief valve
28 Silencer
29 Check valve
30 Intake line
31 Exhaust manifold
32 Cylinder head
33 Primary catalyst
36 Thermovalve 17 °C/62 °F
37 Thermovalve 50 °C/122 °F
50 Fuel tank
51 Vent valve unit
52 Charcoal canister
53 Purge valve
a Leak-off connection

Color code
bk = black
bl = blue
gr = green
ye = yellow
re = red
wh = white
pu = purple

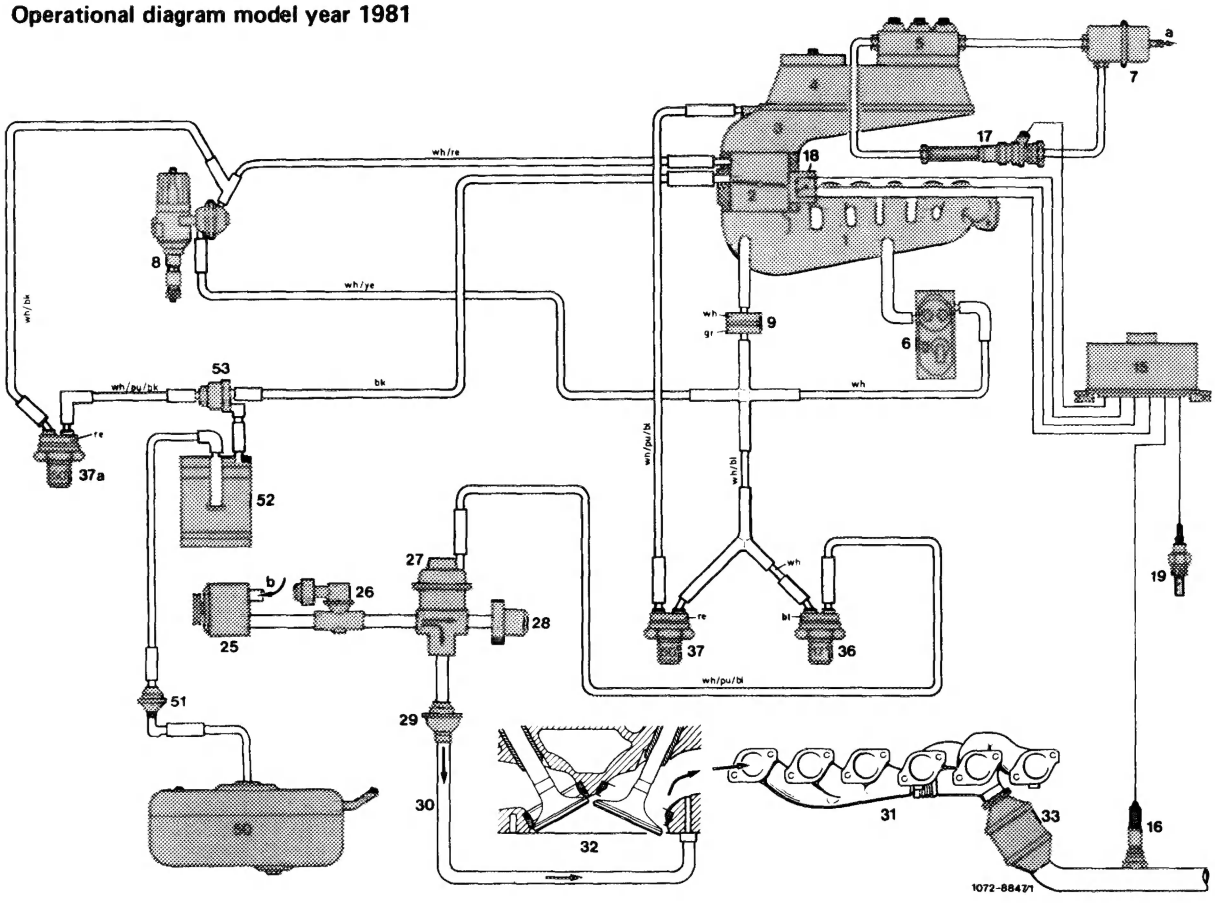
Identification of vacuum lines model year 1981

The basic color of vacuum lines for emission control system is transparent (white).

Additional color stripes are used for easier identification of individual functions.

Emission control device	Color coding of originating vacuum line	Color coding of terminating vacuum line
Ignition		
Ignition advance	red	
Ignition retard	yellow	
Air injection	blue	purple/blue
Fuel evaporation control system Thermovalve 50 °C/122 °F	black	purple/black

Operational diagram model year 1981



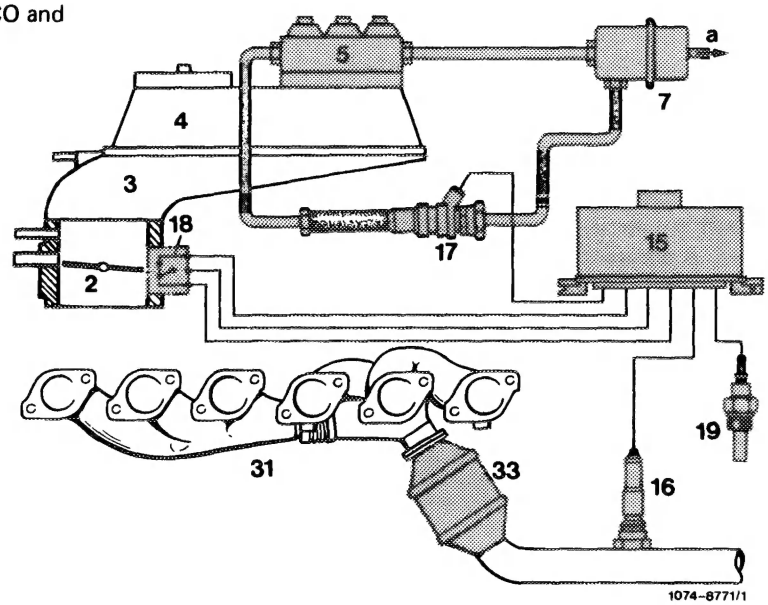
1	Intake manifold	18	Throttle valve switch	36	Thermovalve 17 °C/62 °F
2	Throttle valve housing	19	Temperature switch oil 16 °C/60 °F	37	Thermovalve 50 °C/122 °F
3	Air guide housing	25	Air pump	37a	Thermovalve 50 °C/122 °F
4	Air flow sensor	26	Pressure relief valve	50	Fuel tank
5	Fuel distributor	27	Air relief valve	51	Vent valve unit
6	Warm-up compensator	28	Damper valve	52	Charcoal canister
7	Damper	29	Check valve	53	Pruge valve
8	Ignition distributor	30	Intake line	a	Leak-off connection
9	Orifice	31	Exhaust manifold	b	from air cleaner
15	Control unit	32	Cylinder head		
16	Oxygen sensor	33	Primary catalyst		
17	Frequency valve				

Color code
bk = black
bl = blue
gr = green
ye = yellow
re = red
wh = white
pu = purple

B. Lambda control (λ = lambda)

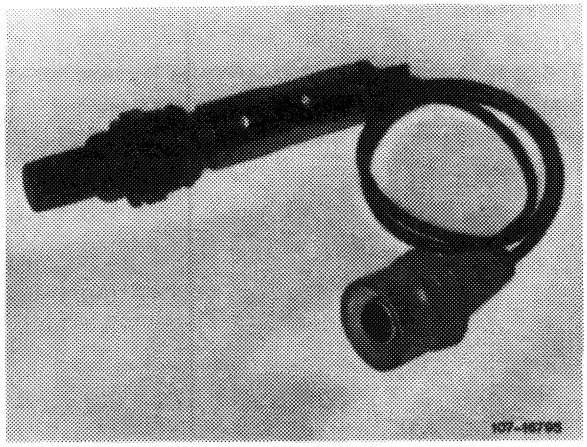
To comply with stricter emission regulations for internal combustion engines, it is necessary to meter the air-fuel mixture more accurately.

Lambda control ensures that a constant air-fuel ratio is maintained at approx. 14.5:1 (λ = 1). This means that an exact proportioning between the injected fuel and the air drawn-in can be obtained. This is the ideal mixture ratio which reduces, in conjunction with the 3-way catalysts, the emissions of HC, CO and NO_x in the exhaust gas to a minimum.



2 Throttle valve housing
3 Air guide housing
4 Air flow sensor
5 Fuel distributor
7 Silencer (damper)
15 Control unit
16 Oxygen sensor
17 Frequency valve
18 Throttle valve switch
19 Temperature switch, oil 16 °C/61 °F
31 Exhaust manifold
33 Primary catalyst
a Leak-off connection

Components of lambda control

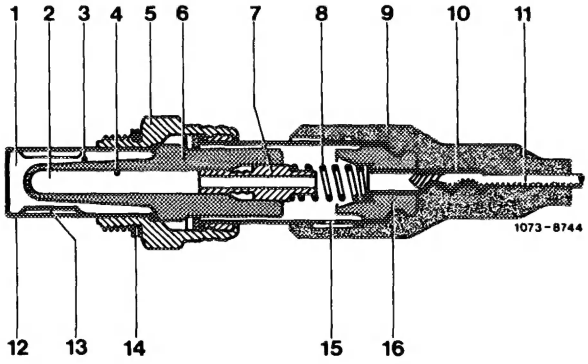


Oxygen sensor

The oxygen sensor is screwed into front part of exhaust pipe and measures the oxygen content in exhaust gases.

Construction

The protective casing (12) protects the ceramic probe (6) against mechanical influences. The outer part of the ceramic body is in contact with the exhaust gases, the inner side with the surrounding air. The ceramic surfaces are coated with a thin layer of gas permeable platinum. In addition, a porous ceramic layer has been added on the exhaust side, which protects the platinum surface underneath against fouling from combustion materials, ensuring a long life of the oxygen sensor.



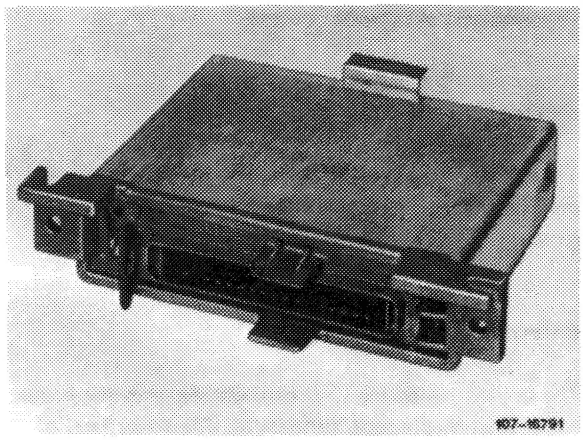
1 Exhaust gas side
2 Outside air side
3 Outer electro-conductive layer
4 Inner electro-conductive layer
5 Probe body with hexagon
6 Ceramic probe
7 Contact bushing
8 Contact spring
9 Protective hood
10 Crimp connector
11 Connecting lead
12 Case
13 Exhaust gas intake slots
14 Sealing ring
15 Fresh air intake
16 Insulator

Function

At a temperature of approx. 300 °C/580 °F, the ceramic material becomes conductive to the oxygen ions. A different amount of oxygen between either side (exhaust gas side and fresh air side) of the adjoining surfaces and induces an electrical potential. The value of this potential represents the measurement for oxygen differential on both sides of the oxygen sensor. The oxygen sensor is highly sensitive at a range of $\lambda = 1$ and transmits this output signal as actual value into control unit.

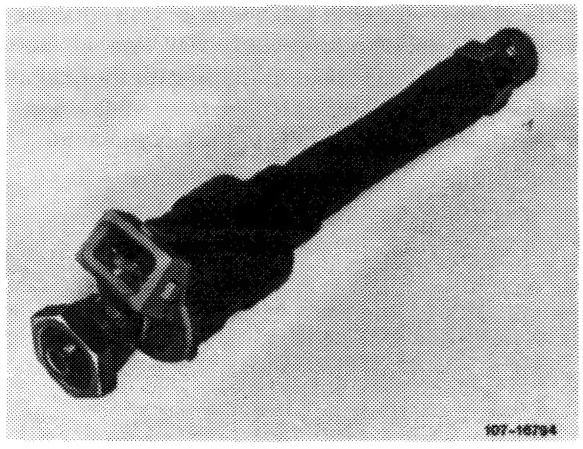
Control unit

The control unit is located in righthand legroom behind lateral paneling. The unit comprises a printed circuit which controls the air-fuel mixture to the ideal value of $\lambda = 1$.



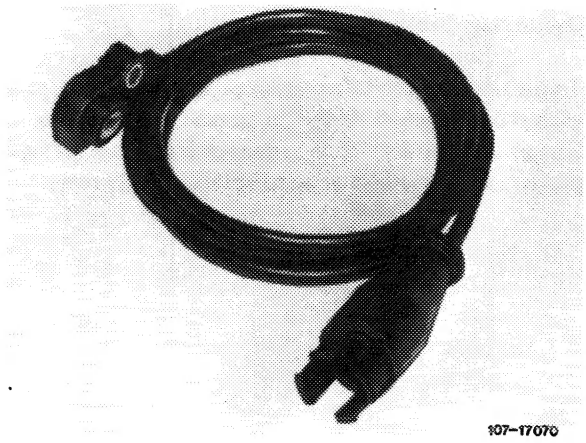
Frequency valve

The frequency valve is attached to the air flow sensor housing. It is connected to a fuel line from the lower chamber of the fuel distributor via pressure damper (silencer) to the return line of the warm-up compensator.



Throttle valve switch

The throttle valve switch is attached to throttle valve housing and has two functions: idle speed and full load contact.



Idle speed contact

The idle speed contact on throttle valve switch limits the control range and thereby serves to stabilize idle speed.

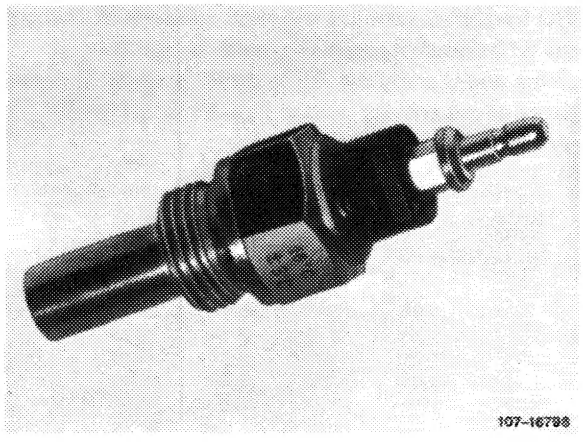
Full throttle contact

When the vehicle is driven in full throttle range (throttle valve at full throttle stop) the full throttle contact in control unit serves to set a fixed on/off ratio 60 : 40 (slightly richer).

Temperature switch oil 16 ± 3 °C/61 ± 5.4 °F

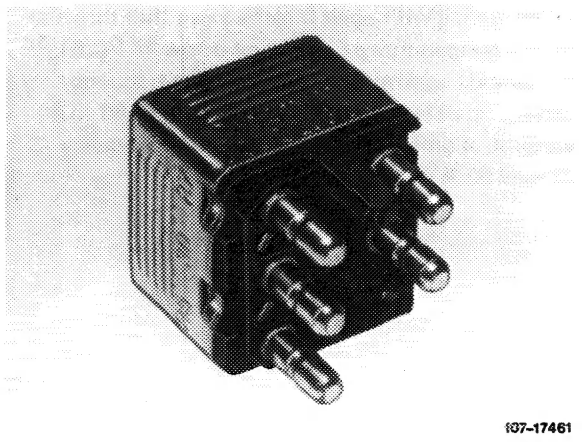
The temperature switch is screwed into oil filter top. Below approx. 16 °C/61 °F engine oil temperature the control unit is connected to minus by way of the closed temperature switch and is set to a fixed on/off ratio of 60/40.

The temperature switch opens at approx. 16 °C/ 61 °F engine oil temperature and interrupts the minus connection. The control unit will then take charge of on/off ratio.



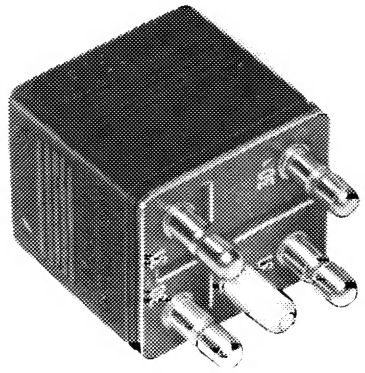
Voltage supply relay

A relay is installed under instrument panel behind glove box for voltage supply to lambda control.



Overvoltage protection

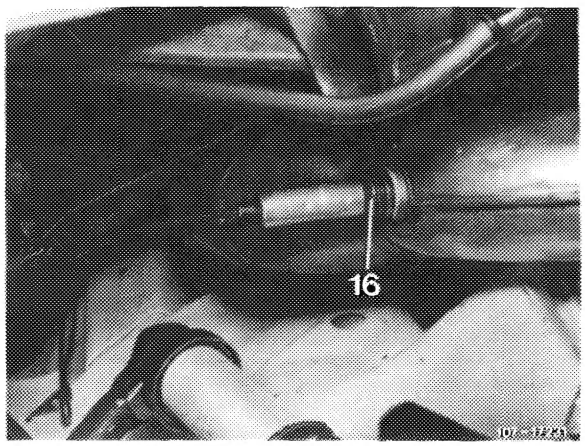
To prevent damage to components of lambda control caused by increased voltage of vehicle circuit (quick-charging of battery, loose battery pole) an overvoltage protection is attached prior to voltage supply relay.



154-17174

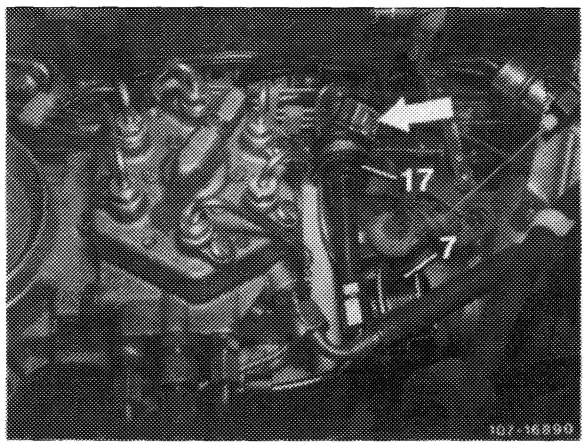
Operation

The oxygen probe (16) is screwed into front exhaust pipe and provides a voltage at an operating temperature above 300 °C/572 °F depending on oxygen content in exhaust gas and thereby informs the control unit whether the air-fuel mixture is richer or leaner than $\lambda = 1$.

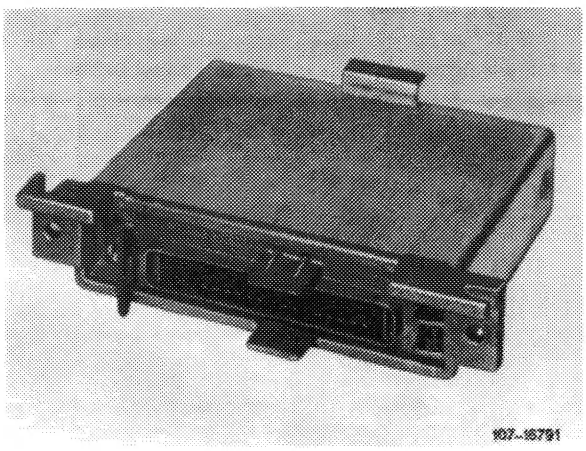


The signal coming from the oxygen probe is converted in control unit into voltage signals which are then transmitted to the frequency valve (17).

The frequency valve is a magnetic valve which changes the differential pressure on control slot of control piston and thereby the injected fuel quantity in dependence of the arriving voltage signals (on/off ratio) (refer to 07.3 Fuel distributor).



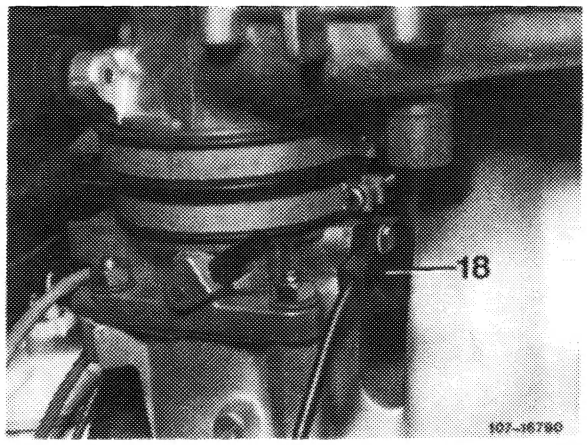
When driving with open throttle valve (full throttle) or at a temperature of engine oil below 16 °C/61 °F the lambda control is inoperative. The frequency valve is operated at a fixed on/off ratio of 60 to 40 via control unit, which means that the frequency valve is 60 % opened and 40 % closed.

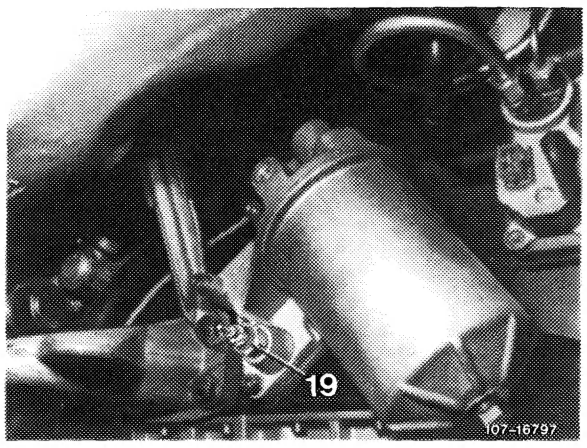


The two operating conditions are activated by the throttle valve switch (18) or the temperature switch for oil (19).

After driving 30 000 miles, a warning lamp "oxygen probe" in instrument cluster indicates that replacement is required.

We are therefore recommending replacement of oxygen probe every 30 000 miles.



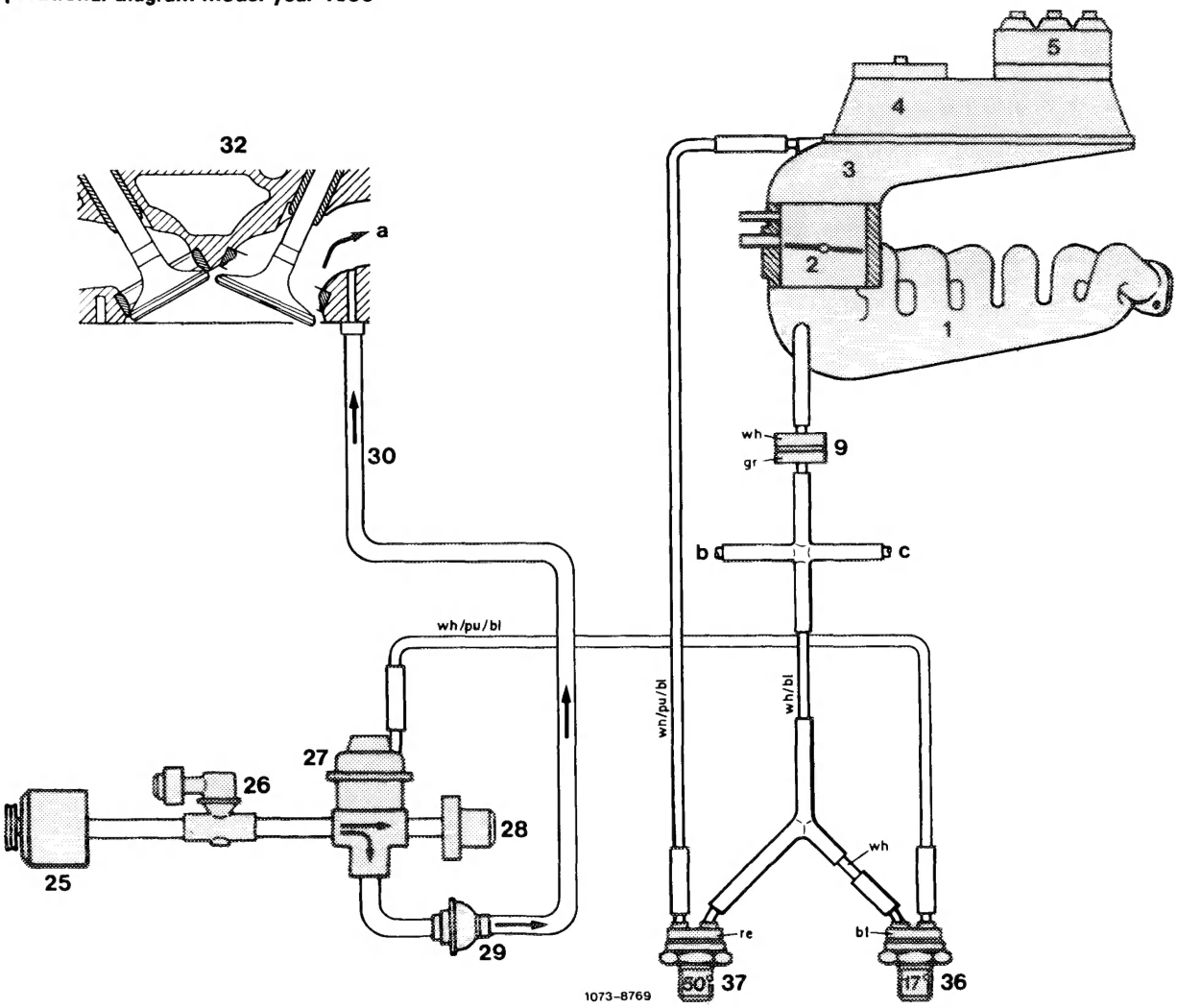


C. Air injection

For maximum warm-up characteristics of engine we recommend the injection of air into hot zone behind exhaust valves at a coolant temperature between 17 °C/62 °F and 50 °C/122 °F.

The oxygen probe will then detect a lean mixture and the air-fuel mixture will be slightly enriched via control unit.

Operational diagram model year 1980



1	Intake manifold	26	Pressure relief valve	a	To exhaust manifold
2	Throttle valve housing	27	Air relief valve	b	To ignition distributor
3	Air guide housing	28	Silencer	c	To warm-up compensator
4	Air flow sensor	29	Check valve		
5	Fuel distributor	30	Intake line		
9	Orifice	32	Cylinder head		
25	Air pump	36	Thermovalve 17 °C/62 °F		
		37	Thermovalve 50 °C/122 °F		

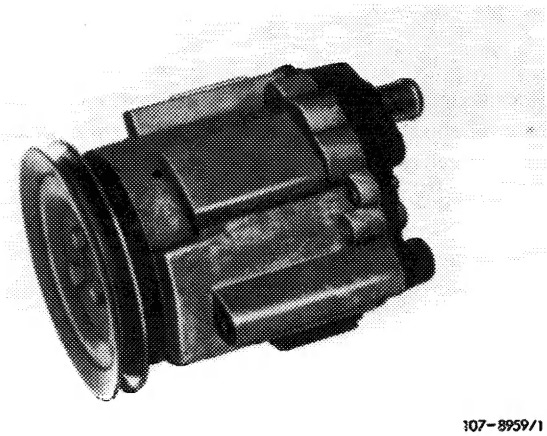
Color code
bl = blue
gr = green
pu = purple
re = red
wh = white

Components of air injection system:

Air pump model year 1980

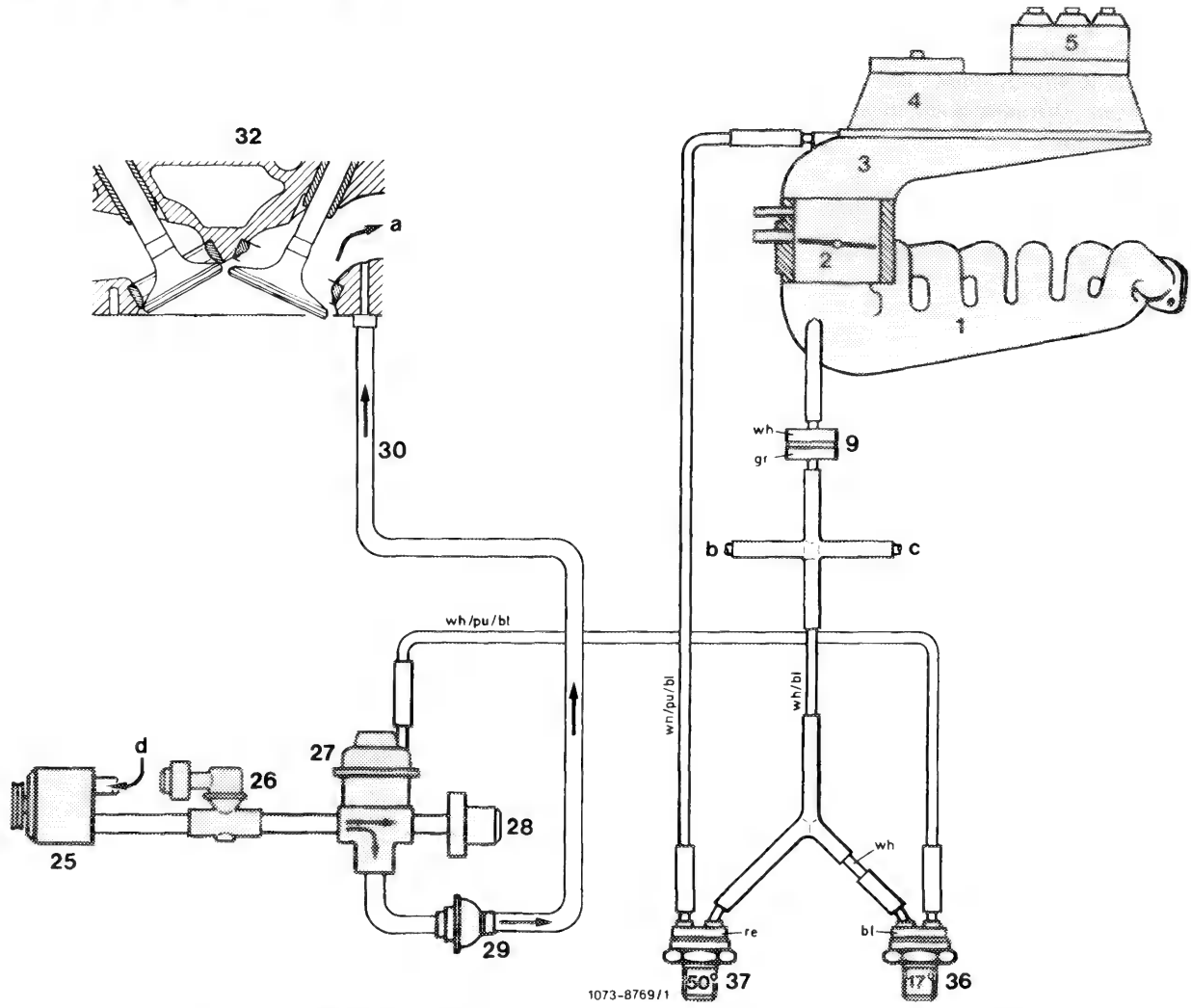
The air pump is a vane-type (impeller) pump with maintenance-free rotary filter, which cleans the sucked-in air.

Fastening of air pump has been changed from inch to metric threads. As a result, the fastening bracket has also been changed.



107-8959/1

Operational diagram model year 1981

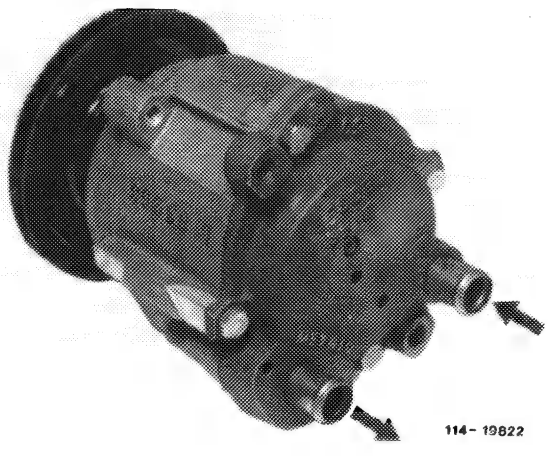


1	Intake manifold	26	Pressure relief valve	a	To exhaust manifold
2	Throttle valve housing	27	Air relief valve	b	To ignition distributor
3	Air guide housing	28	Silencer	c	To warm-up compensator
4	Air flow sensor	29	Check valve	d	From air cleaner
5	Fuel distributor	30	Intake line		
9	Orifice	32	Cylinder head		
25	Air pump	36	Thermovalve 17 °C/62 °F		
		37	Thermovalve 50 °C/122 °F		

Color code
bl = blue
gr = green
pu = purple
re = red
wh = white

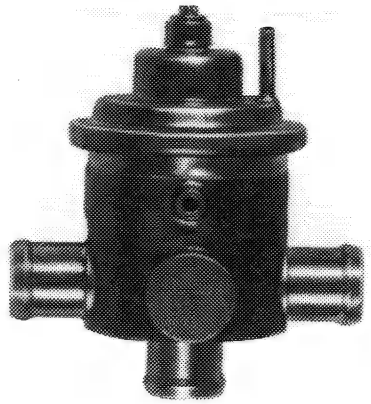
Air pump model year 1981

The air pump sucks the intake air from clean air end of air cleaner. To make sure that no oil or condensate is sucked up by engine breather, a rubber hood is mounted inside in air cleaner. The air cleaner and the air pump are provided with one connection each.



Air switchover valve (air relief valve)

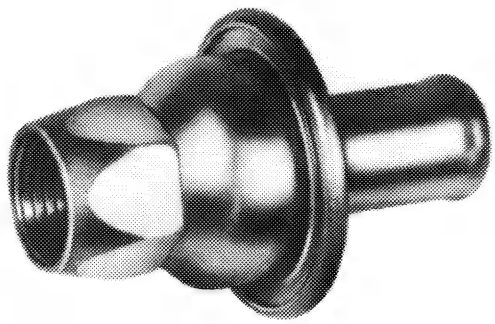
Design and operation of air switchover valve (41) is similar to already known air relief valves with breather. However, this valve is employed here to switch over air injection.



107-9139

Check valve

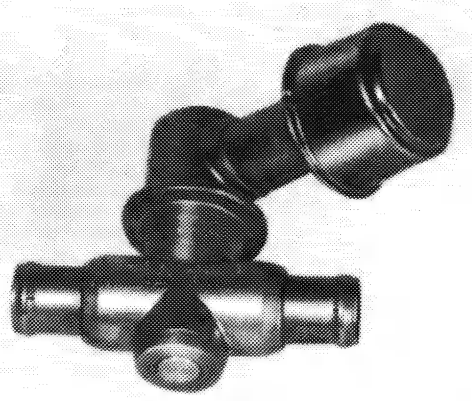
The check valve prevents hot exhaust gases from entering air line.



107-9193

Pressure relief valve

Excess air delivered by air pump at high engine speeds is diverted into the open air by the pressure relief valve starting at a line backpressure of approx. 0.266 bar gauge pressure. An air filter is mounted on pressure relief valve for silencing.

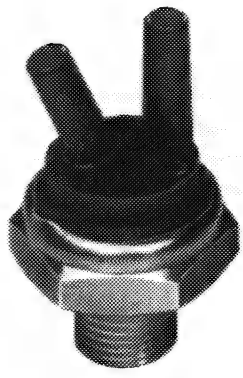


107-13007

Thermovalve 17 °C/62 °F (color code blue)

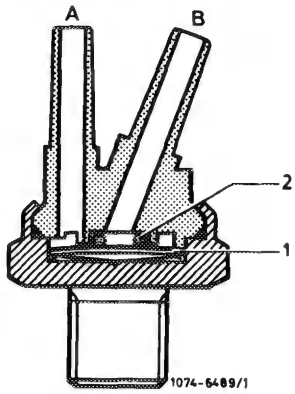
The thermovalve is screwed into sensor box of cylinder head and **opens** at approx. 17 °C/62 °F coolant temperature. Below 17 °C/62°F coolant temperature the bimetallic strip rests against O-ring and closes connection "B".

Above 17 °C/62 °F coolant temperature the bimetallic strip will snap downwards under influence of heat. Both connections are connected to each other.



107-10895

The vacuum line to intake manifold should be plugged to connection "B", since this alone will guarantee absolutely tight sealing between bimetallic strip and O-ring.



1 Bimetallic strip
2 O-ring
A Vacuum terminating line
B Vacuum originating line

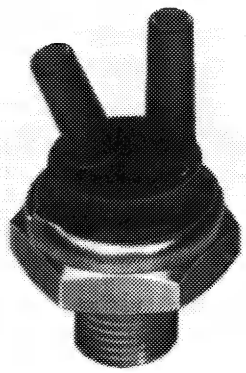
Thermovalve 50 °C/122 °F (color code red)

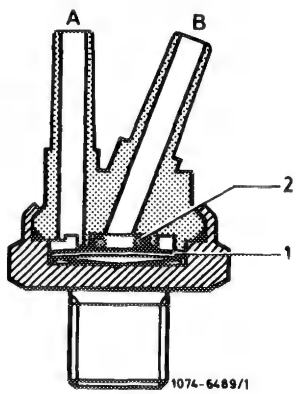
The thermovalve is also screwed into sensor box of cylinder head and **opens** at approx. 50 °C/122 °F.

Below 50 °C/122 °F the vacuum of primary thermovalve 17 °C/62 °F cannot be reduced via thermovalve 50 °C/122 °F.

Above approx. 50 °C/122 °F coolant temperature the bimetallic strip reverses under influence of heat and connection (A) to air guide housing is cleared.

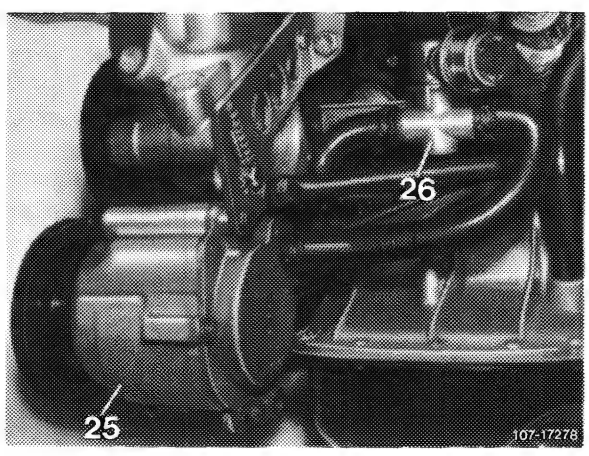
The vacuum hose from thermovalve 17 °C/62 °F or intake manifold should always be plugged to diagonal connection (B), since this alone will guarantee absolutely tight sealing with valve closed.



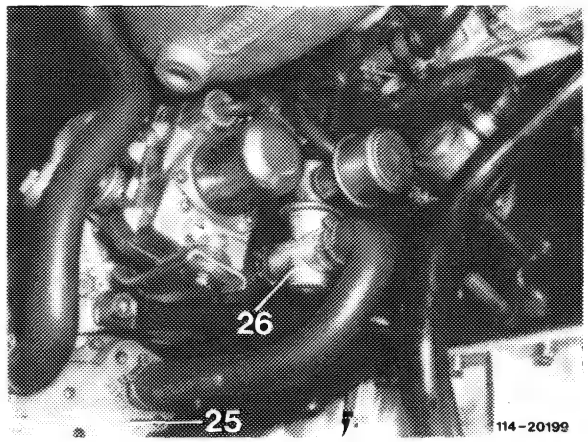


Operation

The air pump (25) driven by the crankshaft by means of a V-belt is continuously delivering air when the engine is running. The air flows to pressure relief valve (26), which diverts excess air delivered at high engine speeds into the open air starting at a back-pressure of approx. 0.266 bar.

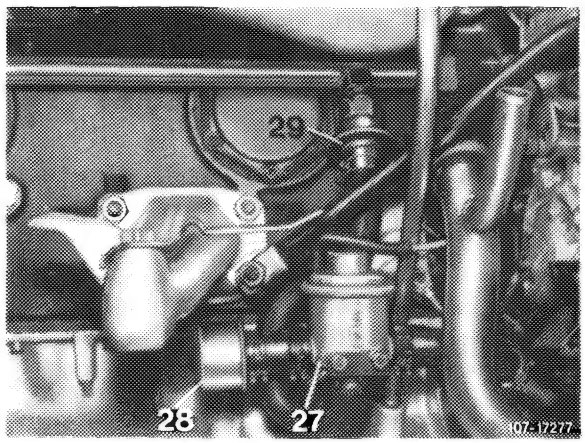


Model year 1980

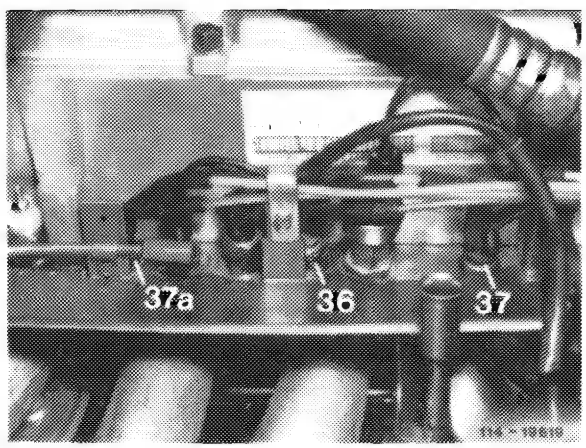


Model year 1981

From pressure relief valve (26) the air is either blown into the injection ports in cylinder head or through silencer (28) into the atmosphere.

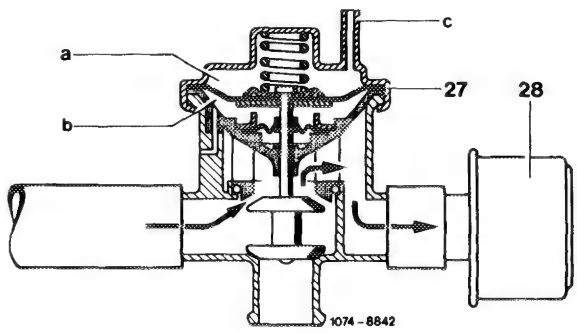


The air switchover by means of diverter valve is controlled via thermovalves 17 °C/62 °F (36) and 50 °C/122 °F (37).



Three temperature ranges will result:

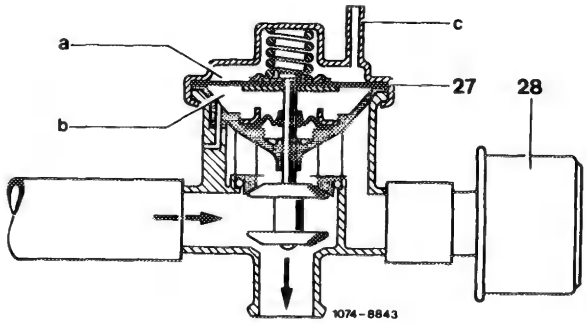
1. Coolant temperature below 17 °C/62 °F
(air diverted to atmosphere)



Thermovalves (36 and 37) are closed and the upper diaphragm chamber (a) of diverter valve (27) is positively vented. The injection line to cylinder head is closed by compression spring in diaphragm chamber (a), the delivered air is diverted to atmosphere via silencer (28).

This will prevent any thermic overload of catalysts through increased mixture preparation during warm-up.

2. Coolant temperature between 17 °C/62 °F and 50 °C/122 °F
(air injected into cylinder head)



In this temperature range, the thermovalve (36) is open, the intake manifold vacuum will activate the diaphragms of diverter valve (27).

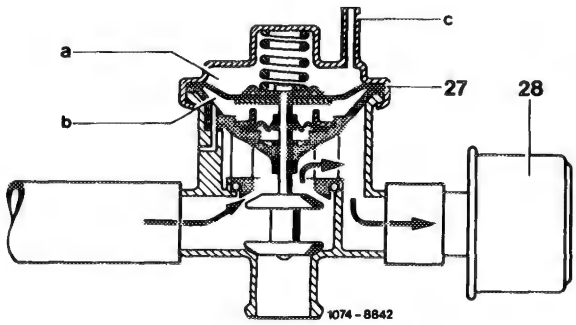
The connection to damper valve (28) is closed and the delivered air is injected via check valve (29), injection line (30) into cylinder head.

The air injection provides an optimal mixture composition during warm-up, because:

1. The mixture enrichment is not cancelled by warm-up compensator upon start of lambda control (approx. 300 °C/572 °F of oxygen sensor).

2. The air injection for the 3-way catalysts, which are already effective at warm-up, is operating at $\approx \lambda = 1$ to provide the exhaust gas composition required for optimal operation of catalysts, even though the engine is operated at $< \lambda = 1$ (richer).

3. Coolant temperature above 50 °C/122 °F
(air diverted to atmosphere)



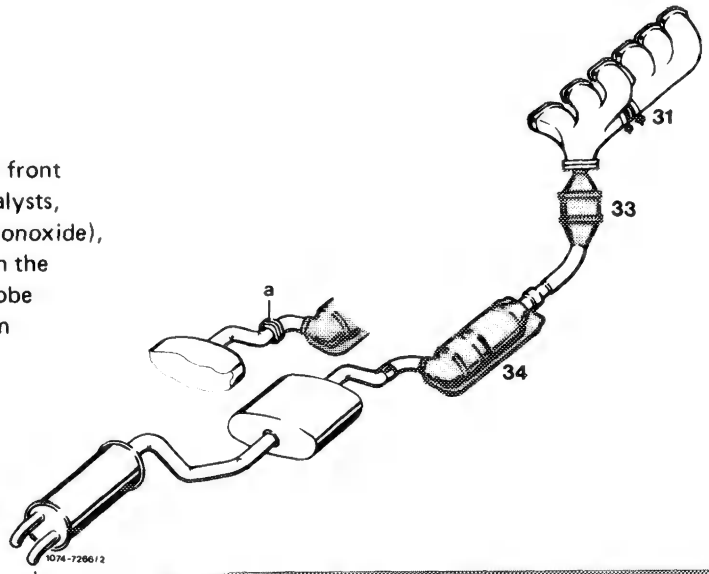
Thermovalves (36 and 37) are open and the vacuum line system (warm-up compensator, ignition retard and air injection) is positively vented.

The compression spring in upper diaphragm chamber (a) of diverter valve (27) closes the connection to air injection line. The air delivered by the air pump is now blown into the atmosphere via silencer (28).

This will prevent any thermic overload of catalysts.

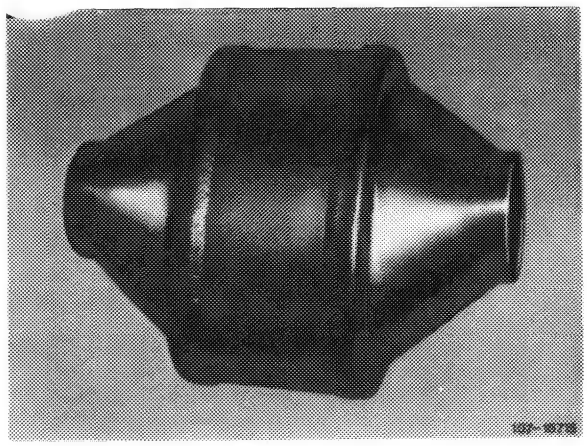
D. Catalysts

The catalysts are located in exhaust system in front of the mufflers and are designed as 3-way catalysts, which means that the shares of CO (carbon monoxide), CH (hydrocarbons) and NO_x (nitric oxides) in the exhaust gases in combination with oxygen probe (at $\lambda = 1$) are uniformly reduced to a minimum quantity.

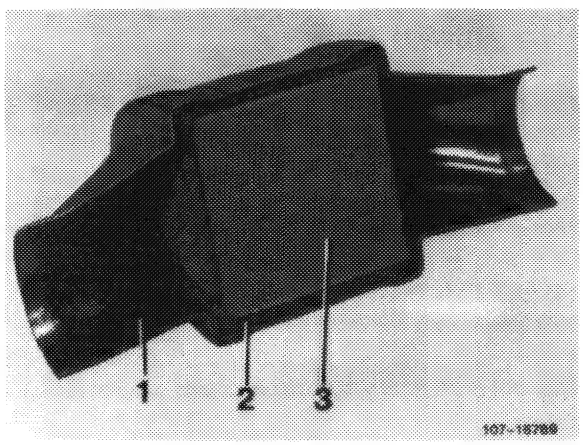


31 Exhaust manifold
33 Primary catalyst
34 Underfloor catalyst
a Flange connection on model 123

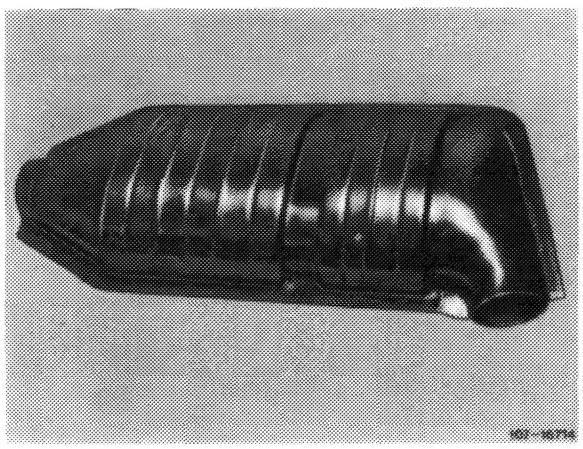
We distinguish between primary catalyst and underfloor catalyst.



Primary catalyst

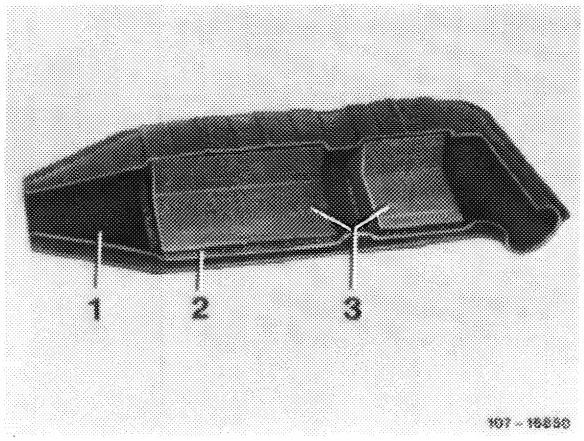


1 Housing
2 Wire mesh
3 Monolith



Underfloor catalyst

The catalysts consist of a monolith (3), a honeycomb structure of ceramic material, which is elastically mounted in a wire mesh structure (2).



1 Housing
2 Wire mesh
3 Monolith

The precious-metal coating on the monolith, the actual catalyst, accelerates the reduction or oxidation of toxic materials.

Operate engine only on unleaded gasoline to keep the catalysts operational.

Avoid overheating the catalysts.

Continued overheating destroys the catalysts, which means that the monoliths may melt.

Catalysts may overheat for the following reasons:

a) Lack of engine maintenance.

   Spark plugs in proper condition are important for the life of catalysts.

b) Due to irregular firing, the fuel-air mixture becomes too rich.

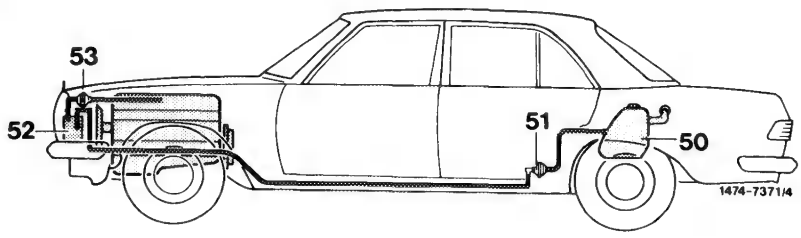
c) Emission control system has been tampered with.

E. Fuel evaporation control system

The fuel evaporation control system is installed to improve emissions which are not related to engine combustion.

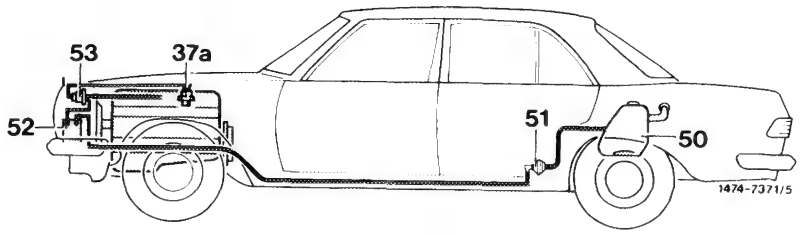
Operational diagram model year 1980

50 Fuel tank
51 Vent valve unit
52 Charcoal canister
53 Purge valve



Operational diagram model year 1981

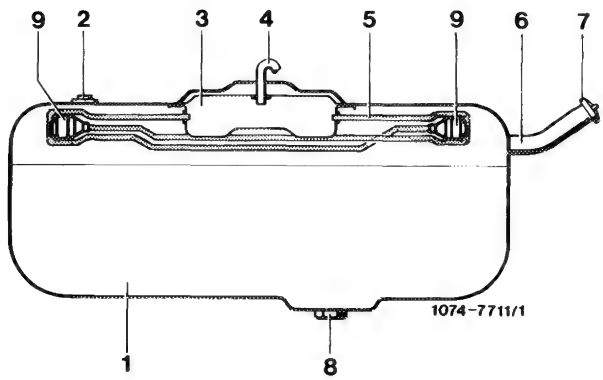
37a Thermovalve 50 °C/122 °F
50 Fuel tank
51 Vent valve unit
52 Charcoal canister
53 Purge valve



Components of fuel evaporation control system:

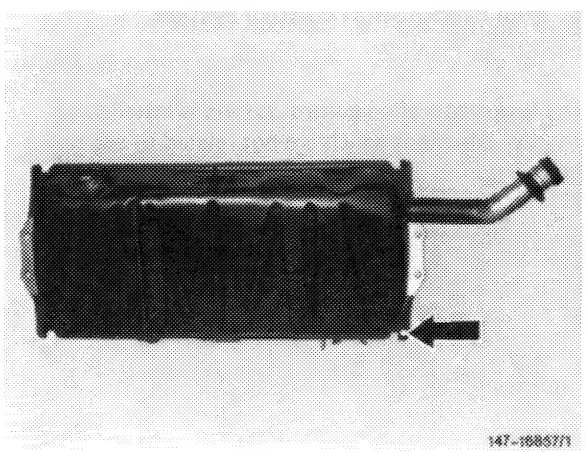
Fuel tank

The positive and negative venting system on model 123 has been modified. One breaker vessel each has been attached at outer ends of tube system.



1 Fuel tank
2 Immersion tube transmitter
3 Compensating tank
4 Connection vent valve unit
5 Tube system
6 Filler neck
7 Closing cap
8 Connecting fuel feed line
9 Breaker vessel

To identify fuel tank with breaker vessels, a 6 mm hole has been drilled below into righthand rim (arrow). If a fuel tank with this designation is replaced, make sure that the spare tank also has this identification for breaker vessels.

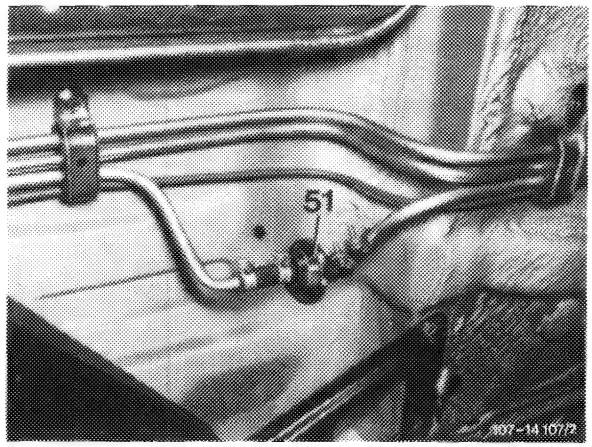


Vent valve unit

The vent valve unit (51) is located under vehicle at level of rear legroom.

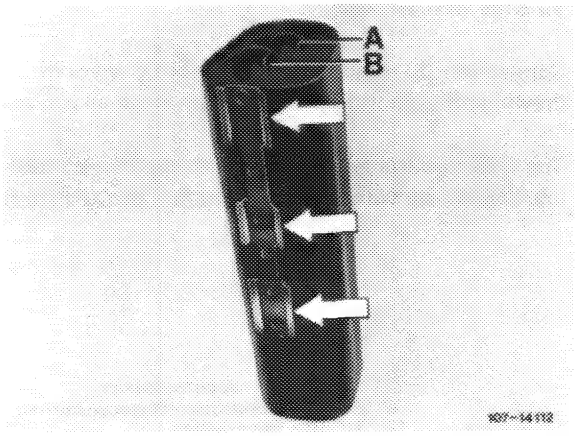
The unit comprises a negative vent valve and a positive vent valve.

Note: The vent valve unit is optionally available in two versions which are, however, identical in function and operation.



Charcoal canister

The fuel evaporation vapors from fuel tank are stored in charcoal canister and drawn-off again from tank while driving.

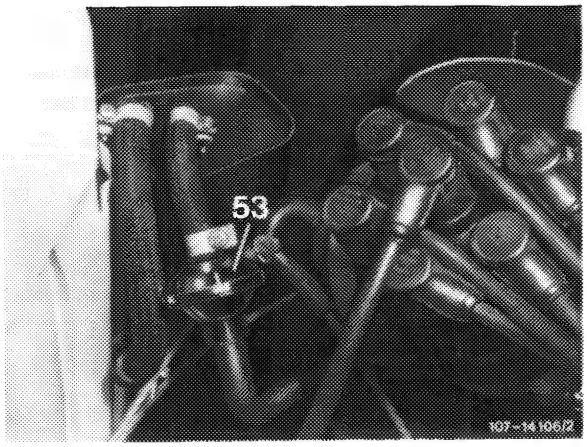


A Draw-off connection
B Connection tank ventilation

Purge valve model year 1980

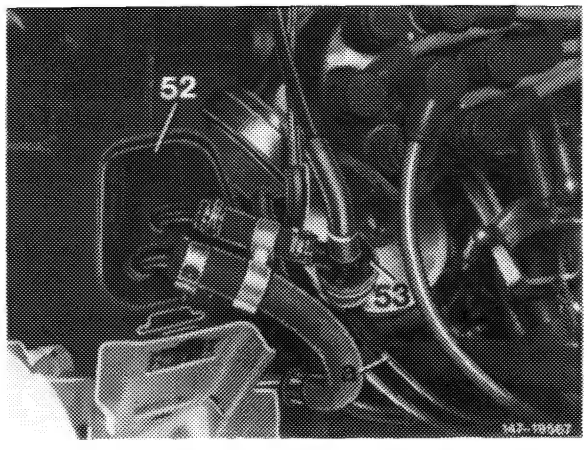
The purge valve (53) is located in the draw-off line from charcoal canister to throttle valve housing.

Note: The purge valve is optionally available in two versions which are, however, identical in function and operation.



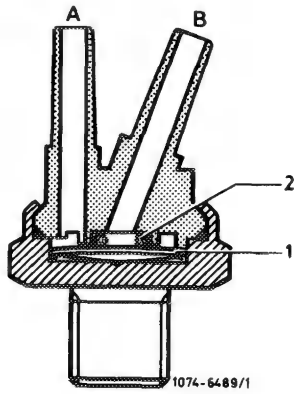
Purge valve model year 1981

The purge valve is also installed in draw-off line from charcoal canister to throttle valve housing. It is identified by the vacuum connection (to thermo-valve 50 °C/122 °F).



Thermovalve 50 °C/122 °F (color code red) model year 1981

The thermovalve is installed in sensor box of cylinder head and opens at 50 °C/122 °F coolant temperature.

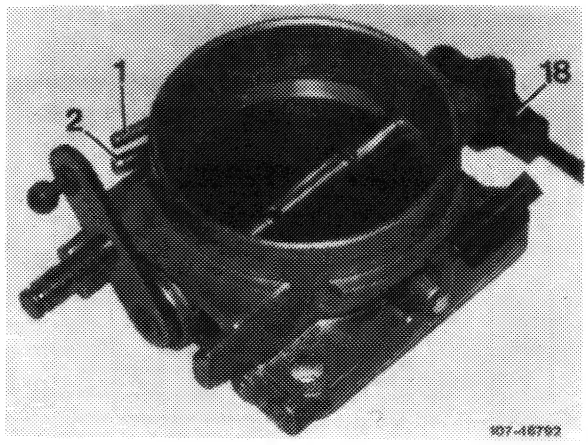


1 Bimetallic strip
2 O-ring
A To purge valve
B To throttle valve housing

Throttle valve housing

Connection (2) on throttle valve housing serves for drawing-off evaporation vapors from charcoal canister.

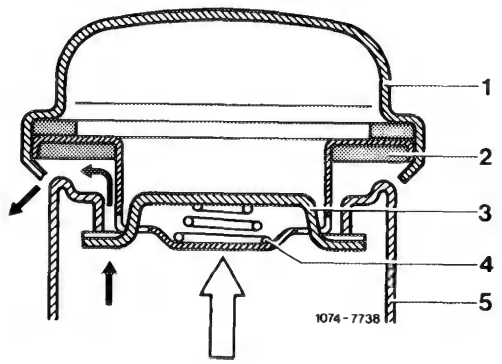
The throttle valve switch (18) is attached for controlling lambda control (idle speed and full throttle stop).



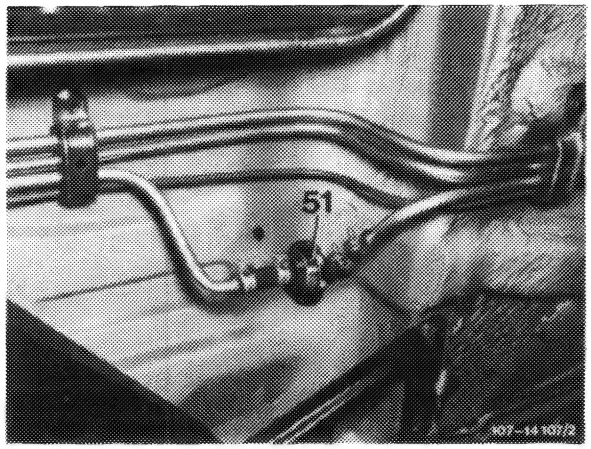
1 Connection vacuum advance
2 Draw-off connection charcoal canister
18 Throttle valve switch

Fuel tank closing cap

The fuel tank cap has been modified starting model year 1978 to prevent increased overpressure in fuel tank.



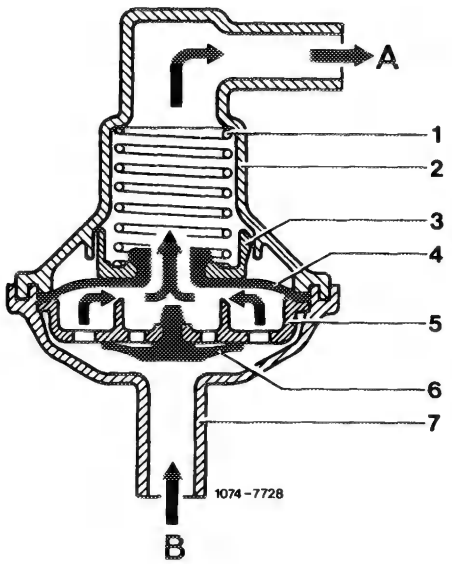
1 Closing cap
2 Sealing ring
3 Clamp
4 Compression spring
5 Filler neck



Evaporation control system model year 1980/81

The vent valve unit (51) increases the pressure in fuel tank to 30–50 mbar. As a result, less fuel evaporation vapors will escape from the fuel tank.

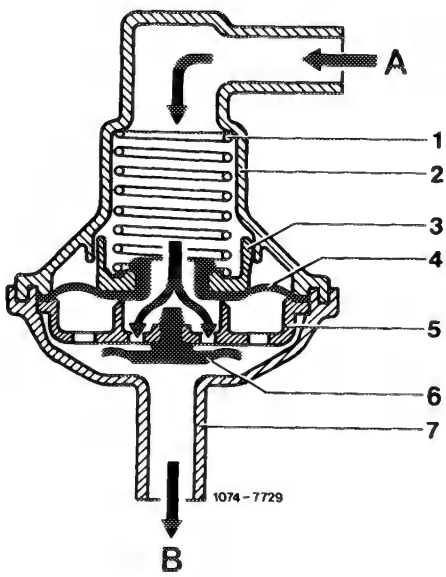
If the pressure in fuel tank attains 30–50 mbar the pressure relief valve (negative vent valve) (4) opens so that the fuel evaporation vapors can flow to charcoal canister where they are stored with the engine stopped.



Vent valve unit to charcoal canister open

1 Compression spring
2 Valve housing
3 Spring retainer
4 Pressure relief valve (negative vent valve)
5 Valve disc
6 Vacuum relief valve (positive vent valve)
7 Connection

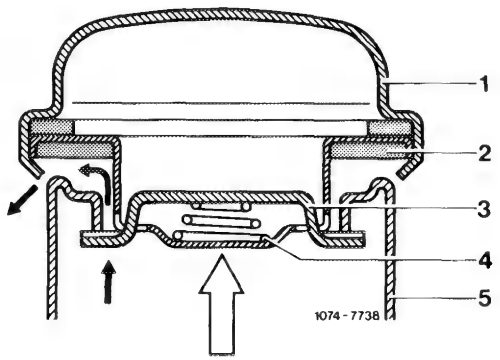
A Connection, charcoal canister
B Connection, fuel tank



Vent valve unit to fuel tank open

When the fuel is cooling down, the reduced volume is compensated by the intake of air or fuel vapors from the charcoal canister via vacuum relief valve (positive vent valve) (6) starting at a vacuum of 1—16 mbar. If the vacuum in the fuel tank drops below 1 mbar, the vacuum relief valve (positive vent valve((6) will close.

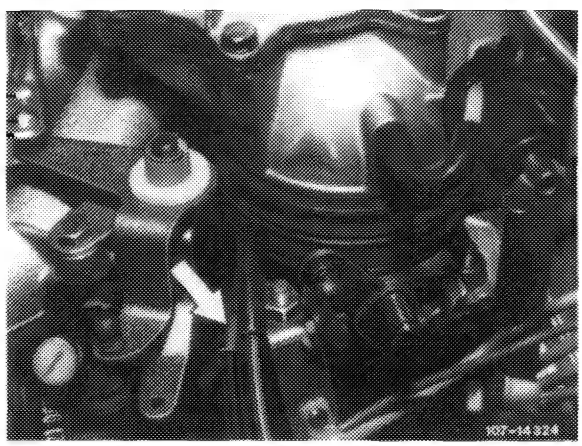
If, as a result of a malfunction in evaporation control system, the pressure in fuel tank increases by more than 0.1—0.3 bar, the fuel evaporation vapors can escape from fuel tank by way of closing cap.



1 Closing cap
2 Sealing ring
3 Clamp
4 Compression spring
5 Filler neck

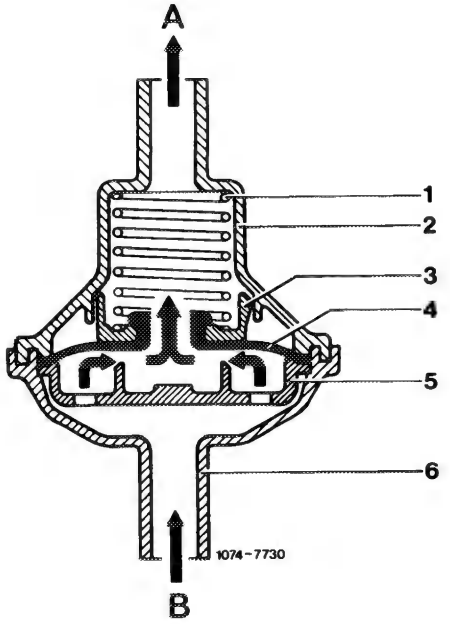
Purge system model year 1980

The charcoal canister is connected to throttle valve housing by means of a line, in which the purge valve is installed.



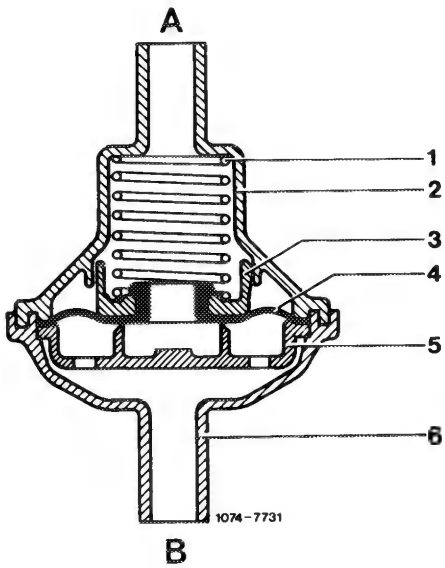
Arrow = drawn-off connection throttle valve

If, with the engine running, the vacuum of 30—50 mbar in purge line is exceeded, the purge valve will open. The fuel evaporation vapors stored in charcoal canister can be drawn off depending on position of throttle valve.



Purge valve opened

1 Compression spring
2 Valve housing
3 Spring retainer
4 Pressure relief valve (negative vent valve)
5 Valve disc
6 Connection
A Connection, throttle valve housing
B Connection, charcoal canister



Purge valve closed

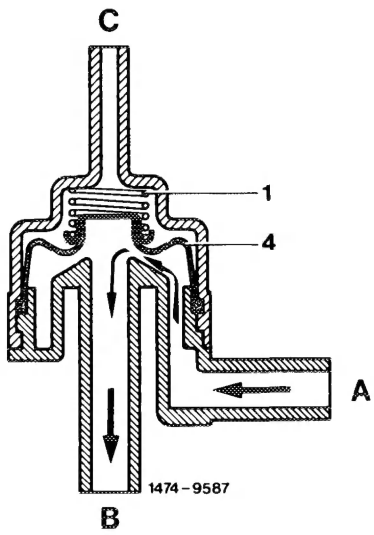
When the throttle valve is opened, the two purge openings, which terminate in a common passage, are progressively exposed to the venturi vacuum. This will result in a metered purging in the lower partial load operating range of the engine without influencing the driving characteristics.

At idle and during deceleration (throttle valve closed) the two purge openings are on atmospheric side of throttle valve. The purge valve is closed, there is no purging of charcoal canister.

Purge system model year 1981

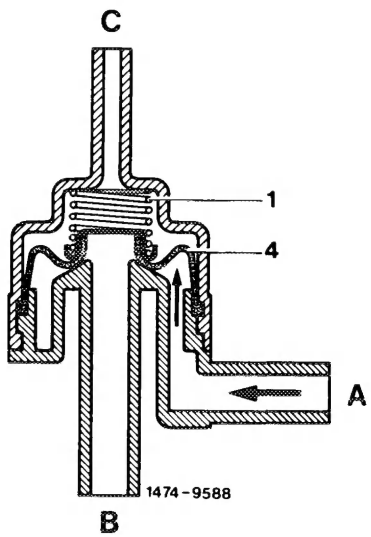
The charcoal canister is connected to throttle valve housing by a line in which the purge valve is installed.

With the engine running and at a coolant temperature above approx. 50 °C/122 °F, intake manifold vacuum is applied to the purge valve through the thermovalve with the throttle valve slightly raised. Diaphragm (4) is pulled in upward direction against the spring force and connection from A to B is made.



Purge valve opened

1 Compression spring
4 Diaphragm
A Connection, charcoal canister
B Connection, throttle valve housing
C Vacuum connection

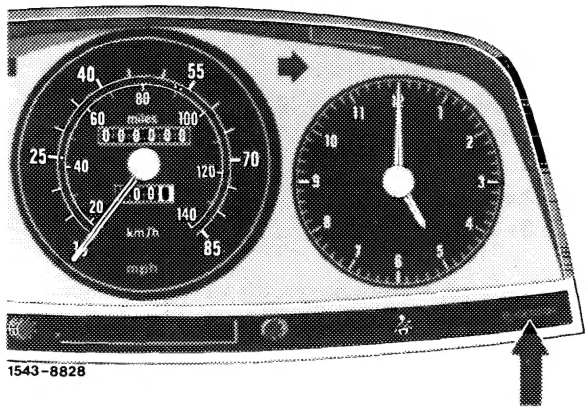


Purge valve closed

F. Oxygen sensor renewal indicator

Emission control legislation specifies that the oxygen sensor must be renewed once after 30 000 miles. This is indicated by an „oxygen sensor" indicator lamp (arrow) in instrument cluster lighting up.

The oxygen sensor is renewed in the USA and in Canada only.

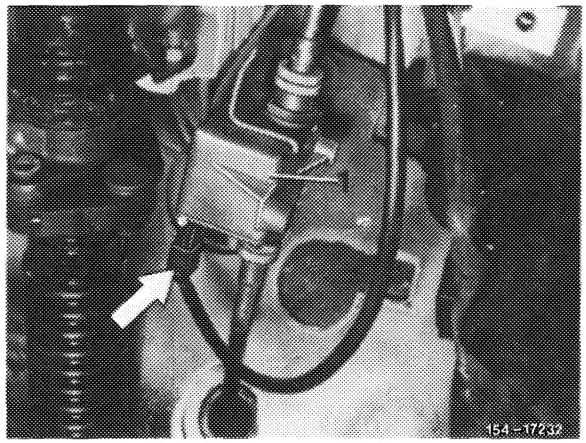


The mileage indicator is attached under instrument panel and is driven by tachometer shaft. When the respective number of miles is attained, a contact will close and the "oxygen sensor" indicator lamp will light up.

After replacing the oxygen sensor, the indicator lamp is made inoperative by pulling-off plug (arrow) on mileage counter.

Note: Prior to installing oxygen sensor, coat its threads with hot lubricating paste 000 989 88 51.

The tightening torque of oxygen sensor is 50–60 Nm.



G. Hints for troubleshooting lambda control

For complaints such as:

Poor warm-up characteristics of engine, hunting at idle, not accepting gas or splashing during acceleration, proceed as follows:

1 Check frequency valve while running engine at operating temperature and at idle, place hand on output end (fuel hose) of frequency valve to check for noticeable operation. If frequency valve is not operating, perform test program (14–100).

2 Check on/off ratio and regulate, if required (07.3–105).

3 Check adjustment of throttle valve switch and correct, if required (07.3–170).

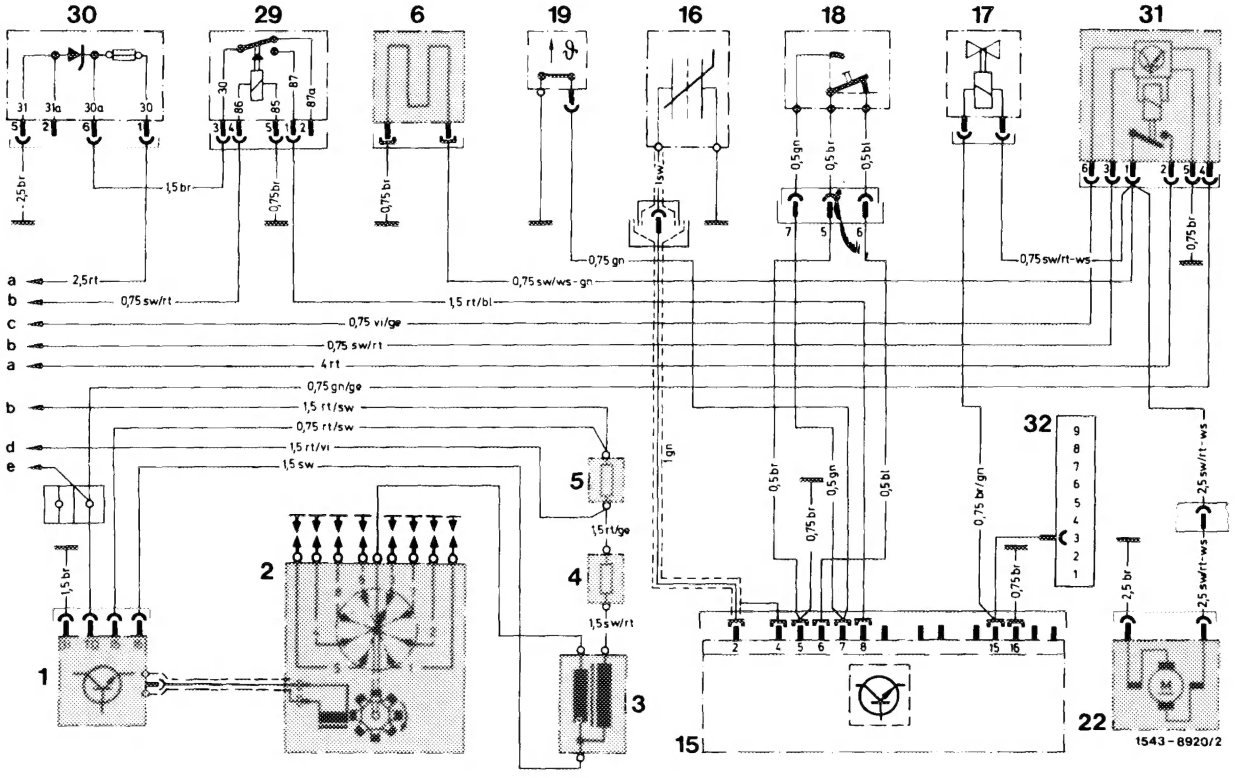
4 Check acceleration enrichment of warm-up compensator (07.3–175).

5 Check fuel pressures and firing point and correct, if required (07.3–120 or 15–500).

6 Check engine for mechanical condition and eliminate faults, if required.

There should be no more faults upon completion of these complaints.

H. Electric wiring diagram lambda control



1 Transistorized ignition switching unit
2 Ignition distributor (engine 117)
3 Ignition coil
4 Pre-resistance 0.6 ohm
5 Pre-resistance 0.4 ohm
6 Warm-up compensator
15 Lambda control unit
16 Oxygen sensor
17 Frequency valve
18 Throttle valve switch
19 Temperature switch 16 °C/61 °F
22 Fuel delivery pump
29 Relay voltage supply
30 Overvoltage protection
31 Fuel pump relay (electronic)
32 Diagnosis socket
a Cable connector, terminal 30
b Fuse box, terminal 15
c Relay air conditioning/starter terminal 87
d Starter, terminal 16
e Diagnosis socket, bushing 1